

Contributions to the Knowledge of the Alpheid Shrimp of the Pacific Ocean

Part III. On a Small Collection from Onotoa, Gilbert Islands¹

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THIS PAPER reports on a small collection of snapping shrimp made at Onotoa in the southern Gilbert Islands during the summer of 1951 by the members of the Coral Atoll Research team during the investigation of the total ecology of the atoll under the sponsorship of the Pacific Science Board with funds from the Office of Naval Research (Contract NR 160-165). Members of the team working on the ecology of marine animals were Dr. Preston E. Cloud, Jr. of the U. S. Geological Service, Dr. Donald W. Strasburg, Dr. John E. Randall, and myself. The latter three at the time were with the University of Hawaii.

The study of these shrimp was initiated under a grant administered by the U. S. National Museum and the Pacific Science Board under a contract between the Office of Naval Research, Biology Branch, and the National Academy of Sciences (NR 160-175); some help in the final phases of the study was gained through a grant from the National Science Foundation (NSF-G-1754). I also wish to acknowledge the aid that was given me in the field by Drs. Cloud, Strasburg, and Randall.

In order to save space and time in this paper, as in the second study, instead of giving complete synonymy and bibliographic references for each species, reference will be made to the earlier papers of the series whenever a species has been listed before.

Type specimens of the new species described in this paper will be deposited in the

institution from which they were borrowed; those types in my personal collection will be deposited either in the U. S. National Museum or the Bernice P. Bishop Museum.

ONOTOA ATOLL

Onotoa is a small, relatively dry atoll in the southern portion of the Gilbert Islands. This portion is known also as the Kingsmill Islands. It lies at 1°47' S., 175°29' E. (north anchorage) and is slightly less than 12 miles long and 5 miles broad, while the land area, reaching along the eastern side of the lagoon, is only slightly more than half a mile wide at the broadest spot (Fig. 1). The windward or eastern side of the atoll has a broad reef flat varying from less than 1,000 to more than 2,000 feet in width; the outer edge of this flat is marked by a shallow trough, then a higher coralline ridge which breaks up into a series of well-developed surge channels; beyond the end of the surge channels is a narrow sloping shelf from 10 to 40 feet deep which drops off abruptly into deep oceanic water. The lagoon is shallow with the deepest measured point about 50 feet, while most of the lagoon area is less than 12 feet deep; large areas near the islands were exposed by low tides. The western edge of the lagoon was marked by an interrupted series of coral reefs growing to near the surface with shallow passes between them. The western edge of the atoll drops off into deep water almost as abruptly as does the eastern except off the northern anchorage to the west of the chief village. (Dr. Cloud has an extensive report on the physical and biological condition of the atoll in his 1952 report.)

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COLLECTIONS AND HABITATS

Unfortunately the collections from Onotoa are not very extensive. An infected leg prevented me from collecting for about half of the 10 weeks we spent on the island, and in the short time remaining I had to devote full time to making the ecological survey, collecting snapping shrimps only as they appeared in the transects. Most of this small collection was lost in transit from Onotoa via Kwajelein to Hawaii and, eventually, only a small proportion of the shrimp collected at Onotoa arrived in Honolulu. Most of the specimens available for study were those collected by Dr. Cloud incidental to his studies on marine geology. However, small as the collection is, it is important for there have been no previous records from the Gilbert Islands.

On the windward reef a transect 20 feet wide was taken normal to the beach line and reaching to the coralline ridge, 750 feet to seaward. Because of the great diversity of habitats and the limitations of time no extensive transects were taken on the lagoon side, but the different shallow water habitats were sampled individually (see Banner and Randall, 1952).

The ecological notes on the stations from which shrimp were examined (it should be noted that alpheidids were collected at almost all stations) are as follows:

A-1. Starting with division between beach rock and higher sand beach, at about 2.4-foot tide zone, reaching seaward 50 feet; substrate of consolidated reef limestone; many tide pools, the largest up to 20 feet long, 5 feet wide, and 6 inches deep; both exposed areas and bottoms of tide pools with scattered loose rocks up to a foot square and 6 inches thick.

A-2. 50–100 feet from beach line, about 2.2-foot tide zone; similar in nature to A-1, but with fewer and smaller tide pools.

A-3. 100–150 feet from beach line, about 2.0-foot tide zone; substrate similar to A-1, A-2.

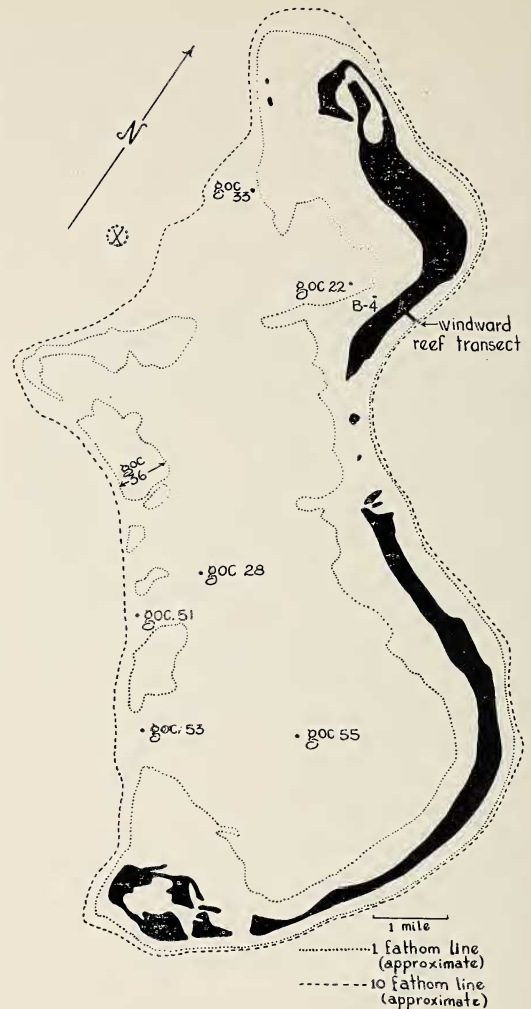


FIG. 1. Onotoa, Gilbert Islands, showing localities of collections. Place indicated by X is approximately $1^{\circ}47' \text{ S.}$, $175^{\circ}29' \text{ E.}$

A-6. 250–300 feet from beach line, about 1.4-foot tide zone; about 30 per cent of area covered by very shallow tide pools. Substrate changing to a coralline algal sheet overgrowing dead coral heads *in situ* with numerous small holes passing through sheet into cavities remaining between the coral heads.

A-7. 300–350 feet from beach line, about 1.2-foot tide zone; about 80 per cent of the area covered by 1-inch-deep tide pools that only drain on extreme low waters; substrate as in A-6, but carpeted by thick tufts of green

algae in which many animals live; some loose rocks, several feet across, under which most of the snapping shrimp were collected.

A-10-12. 450-600 feet from beach line, 0.8-0.4-foot tide zone; about 70 per cent covered with shallow tide pools; substrate, algal covering, rocks similar to A-7; collecting of shrimp done at random in area wherever larger rocks occurred.

B-4. On sandy lagoon beach, about 0.0-2.0-foot tide level, 400 to 1,000 feet from high tide line; snapping shrimp collected from heads of dead coral protruding above the sand beach.

The following stations were those made by Dr. Cloud in which alpheids were collected:

GOC-22. Station nearly in line with B-4 above, 1,200 feet from shore, about 4-6 feet deep at low tide; substrate similar to B-4, but with more living and dead coral.

GOC-28. Middle lagoon region, from reef patches from 6 to 14 feet deep.

GOC-33. On outer edge of outer or western reef growth; depth from surface (low tide) to about 24 feet; flourishing coral growth.

GOC-36. Across surface of outer or western reefs; depth less than 6 feet; extensive coral growth separated by sandy areas.

GOC-51. In pass through western reef front; collections from coral patches, mostly of living coral, rising from sandy bottom at 15 feet to within 8-10 feet of surface.

GOC-53. A pass similar to GOC-51, bottom at 18 feet, coral patches rising to within 4 feet of surface.

GOC-55. From deepest spot on lagoon, sounded at 50 feet; bottom sandy to muddy, with scattered low clumps of living and dead coral.

SYNALPHEUS Bate

Synalpheus carinatus (de Man), 1888

For synonymy see Banner, 1957.

LOCALITY: 5 specimens from GOC-53.

DISCUSSION: These specimens, from the same collection that yielded the obviously

closely related *S. consobrinus* de Man, have not been assigned to any of de Man's three subspecies. The subspecies were erected primarily upon the size of the ova, which were reported by de Man to be 0.4-0.5 mm. long in one subspecies, 0.9-1.0 mm. in the second, and 1.2 mm. long in the third. Of these specimens, three were ovigerous with the egg diameters 0.6 by 1.0 mm., 0.65 by 1.1 mm., and 0.65 by 1.5 mm. It was also noted that the smallest eggs had the youngest embryos, while the largest had embryos near hatching. The other characteristics used by de Man in the separation of the subspecies are based on slight differences of variable characteristics, like the notch in the rostral carina, which in even these few specimens varied from well developed to almost nonexistent. Without other less variable characteristics to base the differentiation upon, with this group of specimens showing marked variation in the size of the ova, and with poecilogony well known among the synalpheids (see Coutière, 1899:444 *et seq.*) it appears that the division of the species into subspecies on these criteria is unrealistic.

Synalpheus amboinae (Zehntner)

Fig. 2

Alpheus amboinae Zehntner, Rev. Suisse de Zool. 2: 202, pl. 8, fig. 23 a, b, 1894.

Synalpheus amboinae de Man, Siboga Exped. 39a¹(2): 203, pl. 6, fig. 20, 1911.

LOCALITY: 3 specimens at GOC-53.

DISCUSSION: While these specimens are within the range of variation given by de Man (1911) and agree well with the descriptions of the species, they have been referred to this species with considerable doubts. They were collected at the same locality and at the same time as *S. consobrinus* de Man. These two nominal species differ in the presence of a tooth above the articulation of the large chela, and in slightly different proportions and armature of the telson. With the difference in the size of the specimens reported by de Man, one would suspect that

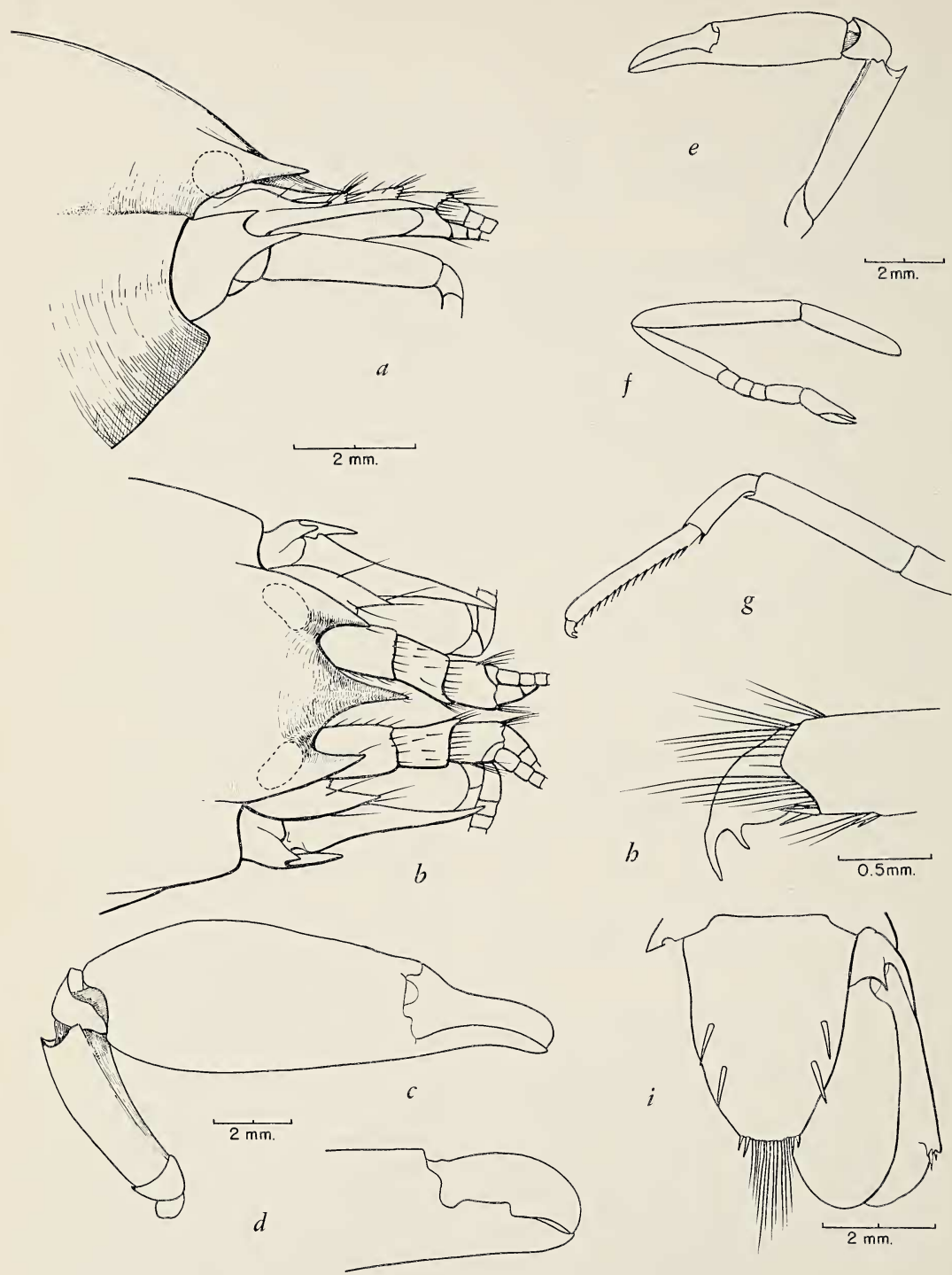


FIG. 2. *Synalpheus amboinae* (Zehntner). *a*, *b*, Anterior region; *c*, large cheliped; *d*, large chela, ventral view; *e*, small cheliped; *f*, second leg; *g*, third leg; *h*, third leg, dactylus; *i*, telson and uropods.

possibly the distinguishing characteristics may be the result of growth and therefore not of specific worth. However, in the absence of an intergrading series of specimens, the species has been permitted to stand.

***Synalpheus consobrinus* de Man, 1909**

For synonymy see Banner, 1957.

LOCALITY: 8 specimens from GOC-53.

DISCUSSION: This group of specimens agreed well with the description and variations of de Man. In general they ran smaller than de Man's type, mostly 15 mm. long or less, yet the females were ovigerous. It is likely that these, together with the closely related *S. carinatus* (de Man) and *S. amboinae* (Zehntner), were collected from crinoids on the coral reef, but the exact data on their capture is lacking. In any case, it seems strange that three different but most closely related species would be living so close to each other in the same basic habitat, and for that reason alone the species should be suspect.

***Synalpheus charon* (Heller), 1861**

***Synalpheus charon obscurus* Banner, 1956**

For synonymy see Banner, 1956.

LOCALITY: 3 specimens at GOC-51, two of *S. charon charon*, one of *S. charon obscurus*.

DISCUSSION: The fact that in this locality two specimens of *S. charon charon*, an ovigerous female and a male, and one ovigerous female of *S. charon obscurus* were found casts some doubts as to the validity of the subspecies. It may indicate that the two forms are mere variations that breed together; it certainly indicates that the subspecies are not geographically distinct, as the other collections have indicated until now. However, as no intergrading specimens have been found and as the data of this collection do not indicate that the two subspecies might not maintain an ecological isolation, it has been decided to leave the subspecies standing.

***Synalpheus paraneomeris* Coutière, 1905**

For synonymy see Banner, 1956.

LOCALITIES: 3 specimens at A-7; 5 specimens at GOC-51.

***Synalpheus coutièrei* Banner, 1953**

For synonymy see Banner, 1957.

LOCALITY: 1 specimen at GOC-55.

***Synalpheus pachymeris* Coutière, 1905**

Synalpheus biunguiculatus var. *pachymeris*, Coutière, Fauna and Geog. Maldives and Laccadive Archipelagoes 2(4): 873, pl. 71, fig. 9, 1905.

Synalpheus pachymeris de Man, Siboga Exped. 39a¹(2): 199, 1911.

LOCALITY: 1 ovigerous female from GOC-55.

DISCUSSION: This sole specimen agrees well with Coutière's description and figures except that the orbital teeth are more pointed, with their outer lateral margins concave, similar to that figured by de Man for *S. quadrispinosus* de Man (1911: pl. 12, fig. 57).

***Synalpheus quadrispinosus* de Man**

Synalpheus quadrispinosus de Man, Nederland. Dierk. Ver., Tijdschr. II, 11(4): 298, 1910; also, Siboga Exped. 39a¹(2): 285, pl. 12, fig. 57, 1911.

Synalpheus quadridens de Man, Nederland. Dierk. Ver., Tijdschr. II, 11(4): 299, 1910; also, Siboga Exped. 39a¹(2): 284, pl. 12, fig. 56, 1911.

LOCALITY: A male and an ovigerous female from GOC-55.

DISCUSSION: de Man described as separate species two closely related forms, both characterized by four spines on the posterior margin of the sixth abdominal segment. They were separated by a series of characteristics, but principally by the form of the orbital teeth and the proportions of the small chela.

The first species, *S. quadrispinosus*, was represented in the Siboga collections by three mature and two immature specimens; the second, *S. quadridens*, by a sole ovigerous specimen lacking the large chela.

In this collection there is a single pair of specimens in good shape (although the male is lacking the small chela) which exhibits a perplexing confusion of the supposedly distinguishing characteristics of the two species as separated by de Man.

Rostrum and orbital hoods: Both specimens are very similar to *S. quadridens*, with the orbital teeth heavy and inflated.

Antennular peduncles: In both specimens the antennular peduncle is assymmetrically developed, with the total lengths of the peduncles approximately the same, but with the basal article of one about 1.3 times the length of the other; however, in general appearance the articles are slender as reported for *S. quadrispinosus*. The stylocerite, to the contrary, is shorter and heavier like that of *S. quadridens*.

Antennae: In the male the scaphocerite is shorter than that of *S. quadrispinosus* (which had the shorter scaphocerite of the two species), while in the female it is longer than *S. quadridens*. The carpocerite is shorter in the male than *S. quadridens* (which had the shorter carpocerite), while in the female the article is long as in *S. quadrispinosus*.

Large chela: In *S. quadrispinosus*, the only species with the large chela described, the chela had a breadth of 0.34 its length, the fingers occupied the distal 0.27 of the length (recalculated from de Man), and there was a rounded-to-acute tooth above the dactylar articulation. In both of these specimens the proportions are exactly the same, with the breadth 0.25 the length, and with the fingers occupying the distal 0.26 the entire length of the chela. In the male the tooth above the the dactylar articulation is heavy and very conspicuous; in the female it is less pronounced and more gradually rounded.

Small chela: This is present only in the fe-

male, where the carpus equals 0.33 the length of the chela; the chela is 3 times as long as broad, with the fingers occupying the distal 0.4. These proportions are close to those of *S. quadrispinosus*, but not exactly the same.

Third leg: In the merus, where the greatest differentiation occurs, the male is 3 times as long as broad, like *S. quadridens*, and the female is 3.8 times as long as broad, like *S. quadrispinosus*.

Sixth abdominal segment: In the male the lateral teeth are narrow and acute like *S. quadrispinosus*, while in the female they are broader and more rounded like *S. quadridens*.

Telson: The proportions are given in the table below:

	MALE	FEMALE	<i>S. quadrispinosus</i> 1.5*	<i>S. quadridens</i> 1.4*
Length/breadth at base	1.3	1.3		
Breadth at base	1.7	2.0	2.1-2.2	2.0
Breadth at tip				
Length/breadth at tip	2.3	2.5	3.2-3.4	2.8

(*Ratios calculated from other ratios.)

From this it can be seen that the telson most closely approached that described for *S. quadridens*.

In summation, the specimens at hand are quite similar to *S. quadridens* in five characteristics, and to *S. quadrispinosus* in five other characteristics. Even if these were not a co-habiting pair—which they probably were, considering that they were collected together—their essential similarities would not permit them to be considered as other than a single species. Their similarities to both *S. quadrispinosus* and *S. quadridens* should establish their close relationship to both of de Man's species and their variable and inconsistent differences with both of de Man's nominal species destroys the validity of de Man's criteria for separation of the two forms. The only conclusion that may be drawn logically is that *S. quadridens* is a synonym (by page priority in the original description) for *S. quadrispinosus* and that *S. quadridens* is a variable species.

ALPHEUS Fabricius
Megacheles Group

Alpheus oahuensis Banner, 1953

Fig. 3

For synonymy see Banner, 1956.

LOCALITY: 1 specimen at GOC-51.

DISCUSSION: It is with considerable doubt that this specimen, a 11 mm. male, is assigned to this species. The rostral front, assymmetrically developed in this specimen, is the same as that of *A. oahuensis*, but the articles of the antennular peduncles are shorter and relatively broader. The merus of the large chela is also slightly heavier, and the tooth on the distal inferior margin is rounded and without an acute tooth. The chela itself is of the same basic form, but more slender in this specimen, and the teeth flanking the articulation of the dactylus are not as well developed. In the small chela the greatest differences occur, for there the fingers are equal in length to the palm, instead of being 1.4 times as long, and are not thin and markedly curved, and do not bear the rounded ridge like those of *A. oahuensis*. The second legs are lacking. In the third legs the armature is similar but the legs are

thinner, with merus 6 times as long as broad instead of 3.4 times; the inferior unguis of the dactylus is smaller.

But in spite of these differences in proportion, the general appearance of the two forms is quite similar, and these differences may be due to growth differences, for the type is 27 mm. long. Moreover, some variation along these lines was found in the paratypic series from Hawaii. However, with only one specimen from Onotoa, it is impossible to decide whether these differences are from individual variation, or from growth, or are constant differences that would be worth subspecific or specific rank.

Alpheus collumianus medius Banner, 1956

For synonymy see Banner, 1956.

LOCALITY: 2 specimens at GOC-51.

Machrochirus Group

Alpheus gracilis var. *simplex*
(Banner), 1953

For synonymy see Banner, 1956.

LOCALITY: 1 specimen from GOC-51.

DISCUSSION: This single specimen agrees

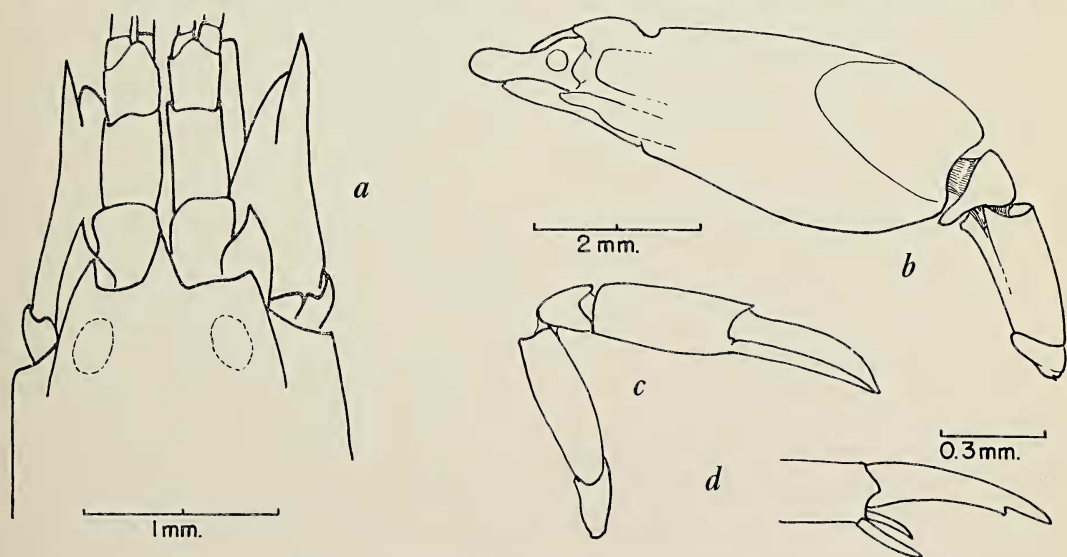


FIG. 3. *Alpheus oahuensis* (Banner). a, Anterior region; b, large cheliped; c, small cheliped; d, dactylus, third legs.

well with the specimens from Hawaii except that the dactylus of the third leg, instead of bearing a smooth convexity, carries an exceedingly small secondary unguis similar to but smaller than that found in *C. brachymerus* Banner (1953: fig. 17j). The external spine of the uropod is colorless.

In considering the specimens from Saipan, Arno, and Onotoa, the question arises as to the taxonomic level of this form. Obviously it is closely related to the *A. gracilis* of Heller, but whether it should be considered as a separate species, as a geographical subspecies, or as a variant—as it is now described—of the basic species, cannot easily be determined. On the basis of the Hawaiian specimens alone it would appear to be a separate species, or at least a subspecies; however, the specimens are from wide-spread localities. Yet none of these extra-Hawaiian forms are exactly like the specimens from Hawaii. It is possible that each of the studied archipelagoes have populations that could be interpreted as separate subspecies; certainly these variations appear to validate the consideration of these or the Hawaiian form as separate species. Yet the samples from the other archipelagoes have not been extensive enough to draw any conclusions about the populations, and many areas of the Pacific have not been sampled at all. Therefore the form is left as it was described originally with a tentative infrasubspecific designation.

Alpheus ventrosus Milne Edw., 1837

Fig. 4

For synonymy see Banner, 1956.

LOCALITIES: 2 specimens at GOC-22, 1 at GOC-33, 2 at GOC-36, 7 at GOC-51.

DISCUSSION: This group of four specimens from GOC-51, together with specimens from Saipan and Arno, present an almost complete intergradation between the small (8.5 mm.) form described as *A. latipes* and *A. ventrosus* which reaches a length of more than 40 mm.

While *A. latipes* as described was similar in general configuration to *A. ventrosus*, the two were distinctly separated by a number of characteristics. In the front of the carapace in *A. latipes*, the rostral carina was narrow and sharp and the orbital teeth were confluent with the front of the carapace, instead of having a flattened rostral carina and having the orbital teeth demarked medially from the margin of the carapace as is a characteristic for *A. ventrosus*. The antennular peduncles and the second and third legs were relatively broader in *A. latipes*. The fingers of the large chela were relatively shorter and the merus of the large and small chela were feebly armed or completely unarmed in *A. latipes*, instead of bearing up to four or five strong spines as in *A. ventrosus*. The dactylus of the third leg was abruptly curved and strongly acute in *A. latipes*, while in *A. ventrosus* the dactylus was of a peculiar blunt form, with a growth on the tip that was reminiscent of a horse's hoof. (Compare figs. 27, 28, Banner, 1953.)

Yet this group of specimens, ranging in size from 8.2 mm. to the adult size, shows an almost perfect intergradation in all of these characteristics. Two of the most marked and most easily observed characteristics, the form of the rostral carina and the form of the dactylus of the third legs, were chosen for detailed study and illustration. The four smaller specimens came from the station mentioned above; the last specimen came from the author's collection from Saipan.

In the 8.2 mm. specimen, the parts are almost identical to those described for *A. latipes*; if anything the dactylus of the third leg is slightly thinner. In the 9.7 mm. specimen the rostral carina does not change, but the dactylus is developing some extra superior and inferior thickenings. In the 10.8 mm. specimen the rostral carina still remains constant, but the dactylus is definitely growing thicker, the hook smaller, and a superior and inferior ridge is becoming more marked. In the 15.4 mm. specimen the interorbital portion of the rostral carina is broader and flatter,

but it still remains a sharp ridge on the anterior portion of the rostrum; the dactylus retains only a trace of the hook, the superior

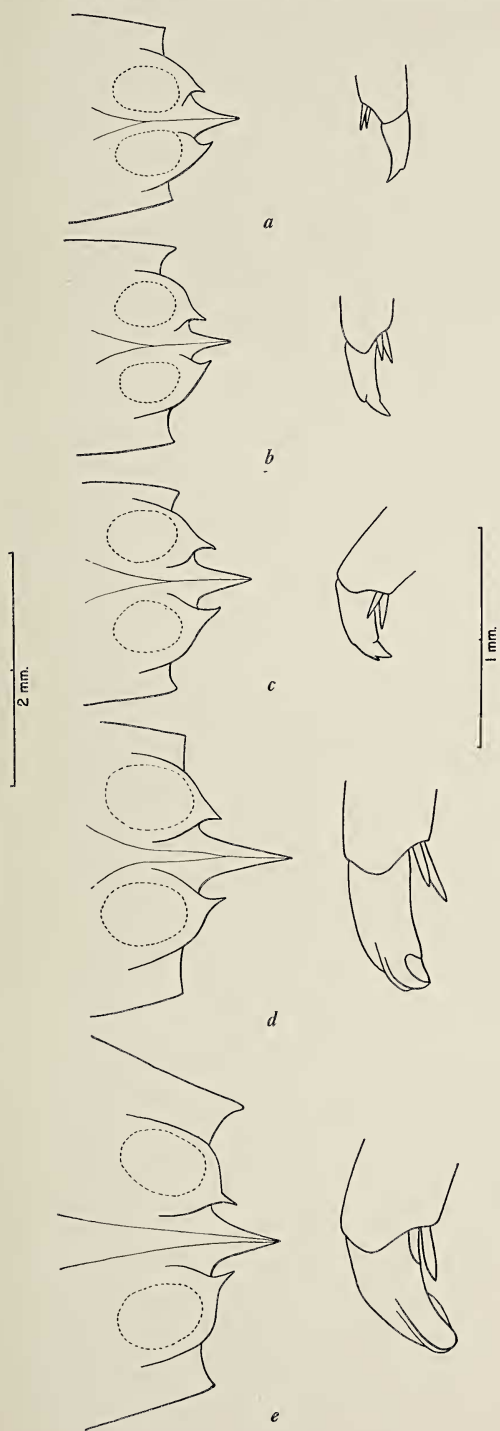
ridge is well developed, and the "hoof" is developing; the last spines of the propodus are thickening, but remain acute. Finally, in the 16.2 mm. specimen, the rostral carina is flattened to the tip of the rostrum, but still not as broad as in the full-sized adults; the dactylus has the structure and proportions of the adult; the last spines of the propodus are broad, distally rounded, but are not yet excavate on the tips, as are found in the mature specimens.

This easily recognizable species, possibly one of the most distinctive species of the genus, appears to have had at least four names applied to it: *A. lottini* Guérin, 1826–1830 (by Stebbing and Barnard, see below); *A. ventrosus* H. Milne-Edwards, 1837; *A. laevis* Randall, 1839; and finally, as discussed above, *A. latipes* (Banner), 1953. Unfortunately the three early names were published with short and generalized descriptions; only the first description carried a figure, and this figure appears to have been inaccurate.

The type specimen of Randall for *A. laevis* probably is lost with the rest of the early types at the Philadelphia Academy of Science, but there is only one species from Hawaii, the type locality, that meets the qualifications of his description including that of size ("length about 1½ inches"). This species is the one now known as *A. ventrosus* (see Banner, 1953: 84, fig. 28).

The type of Milne-Edwards has never been formally redescribed, but its characteristics are known. In *Les Alpheidae* (1899) Coutière discusses and figures specimens that he identifies as *A. laevis* Randall (figs. 54, 201, 251, 263, 307, 324, 325), a form plainly identical with the species from the Hawaiian Islands that has been known as either *A. laevis* or *A.*

FIG. 4. *Alpheus ventrosus* Milne-Edwards, to show developmental stages in the form of the rostrum and dactylus of third legs. *a*, An 8 mm. specimen; *b*, a 9.7 mm. specimen; *c*, a 10.8 mm. specimen; *d*, a 15.4 mm. specimen; *e*, a 16.2 mm. specimen; *a*–*d*, from Onotoa, *e*, from Saipan; carapaces and dactyli with separate scales. (Note: Dactyli are in differing rotation.)



ventrosus. Especially noteworthy are the figures of the dactyli of the third to fifth legs (fig. 324, 325), a characteristic unique within the genus. Then Coutière (1905: 882) reported, "L'examen des types de H. M. -Edwards ne permet aucun doute sur l'identité de l'*A. ventrosus* et de l'espece . . . *A. laevis* . . . Randall." There appears, therefore, no question but that the two names refer to the same species.

However, there is considerable question whether the form described as *A. lottini* by Guérin is this species. Milne-Edwards in his original description of *A. ventrosus* (1837: 353) concludes by saying, "L'Alphée de Lottin dont il a été publié une bonne figure, mais dont la description n'a pas encore paru [the named figure was published about 10 years before the printed description, and in the meantime Milne-Edwards published his work] paraît être très-voisine de l'espece précédente." Stebbing (1915: 82) states, "But the description of *A. ventrosus* does not seem to justify any claim for the priority of that name over Guérin's *A. lottini*." He therefore used the name *A. lottini*. Barnard, in his work on the South African decapods (1950: 748, fig. 141), follows the name used by Stebbing.

However, while Guérin's description and figures do not show any great differences from the generalized description of Milne-Edwards, they do show differences from the form now recognized as *A. ventrosus* and from the types as re-examined by Coutière. In Guérin's figure, the rostrum in *A. lottini* reaches almost to the middle of the second antennular article, instead of to the distal part of the first article; the lateral spine of the scaphocerite is too prominent; the second article of the carpus of the second leg is about 6 times as long as broad instead of 1.5 times; the dactyli of the third to fifth legs are shown as definitely acute. In the description, the wrist of the large chela is described as elongate and cylindrical, instead of short and cyathiform, and the articles of the posterior legs also as cylindrical instead of compressed.

A most important difference is in the color, for the orange-red color of the specimens of this species is one of the most constant colors found in the family, yet Guérin figured it as a delicate lettuce green and described it, "Sa couleur est d'un jaune verdâtre dans l'alkool." It should be noted, too, that the figure does not show any orbital spines, yet Guérin reports these in his description.

It is possible, of course, that these differences are the result of inaccurate description and the types are actually identical; however, there is no reason to presume so, and until the time that Guérin's types are found and redescribed, the name *A. ventrosus* should be accepted. If the types of Guérin should be found to be identical with the species of Milne-Edwards, I would recommend that the little-known and almost never used earlier name be suppressed by the International Commission on Zoological Nomenclature in favor of the long accepted name of this, one of the most common species of the genus.

One other problem raised by Stebbing (*loc. cit.*) was concerned with the identity of the form that Bate called *A. laevis* Randall. "Bate's figure of *A. laevis* in the 'Challenger' report [1888: 555, pl. 99, fig. 3] cannot easily be reconciled with the species here in question." It is true that Bate neither figured nor described the peculiar unguis of the third to fifth legs, and he depicted the legs, especially the second legs, as much too thin, but otherwise the specimen appears to agree with *A. ventrosus*. Moreover, Bate's specimen came from Hawaii, and, as with Randall's specimen, there are no other species in Hawaii that agree even moderately well with the description and figures. It should be noted, also, that Bate shows dark spots on the superior surface of the large and small chelae, a characteristic of the species (cf. Banner, 1953: fig. 28 c, d, e).

The last question that might arise is whether the species identified by Stebbing and Barnard from South Africa as *A. lottini* is the same as *A. ventrosus*. Stebbing's brief description leaves little room for doubt, and Barnard's

excellent figures make it certain that the South African form does not differ in any significant fashion from the Pacific form.

Alpheus machrochirus Richters, 1880

For synonymy see Banner, 1957.

LOCALITY: 1 specimen at GOC-36.

Obesomanus Group

Alpheus lutini Coutière, 1905

For synonymy see Banner, 1956.

LOCALITIES: 1 specimen each at B-4, GOC-28, GOC-53, GOC-55.

Alpheus species

LOCALITY: 2 specimens from GOC-51.

DISCUSSION: These two specimens, both females, appear to be in either the *Obesomanus* group or the *Crinitus* group, and may be related to the complex containing the species *A. obesomanus* Dana, *A. microstylus* (Bate), and *A. lutini* Coutière. These specimens appear to be of a separate species, possibly new, but preliminary work on the variation in this complex indicates that the specific characteristics need re-evaluation. Therefore it has been considered wiser to defer judgement on these specimens until a later paper when the related species are considered.

Crinitus Group

Alpheus brevipes Stimpson

Alpheus brevipes Stimpson, Acad. Nat. Sci. Phila., Proc. 12: 30, 1860.

Crangon brevipes Banner, Pacific Sci. 7(1): 103, figs. 35, 36, 37, 1953 [neotype described].

LOCALITY: 2 specimens at GOC-51.

Alpheus bucephalus Coutière

For synonymy see Banner, 1956.

LOCALITY: 3 specimens at A-7.

DISCUSSION: These specimens exhibited a variation similar to those forms reported upon from Saipan.

Alpheus clypeatus Coutière

Alpheus clypeatus Coutière, Fauna and Geog. Maldiv and Laccadive Archipelagoes 2: 897-898, pls. 81, 82, figs. 36, 36g, 1905.
Crangon clypeata Banner, Pacific Sci. 7(1): 107, figs. 37, 38, 39, 1953.

LOCALITY: 1 specimen at GOC-51.

Alpheus pachychirus Stimpson, 1860

For synonymy see Banner, 1956.

LOCALITY: 1 specimen at GOC-51.

Diadema Group

Alpheus diadema Dana, 1852

For synonymy see Banner, 1956.

LOCALITY: 1 specimen at GOC-36.

Alpheus lanceoloti Coutière

Alpheus lanceoloti Coutière, Fauna and Geog. Maldiv and Laccadive Archipelagoes 2: 900, pl. 83, fig. 39, 1905.

LOCALITY: 1 specimen only from A-3.

DISCUSSION: This specimen, fortunately intact, agrees almost perfectly with the original description by Coutière. The only exception may be in the merus of the large cheliped, which Coutière shows as bearing four immovable denticles proximal to the terminal denticle, and which bears four short but heavy movable spines in this specimen. It should also be noted that the merus of the third leg on one side is like that of the type bearing three movable spines, while on the other side there are four such spines.

Alpheus gracilipes Stimpson, 1860

For synonymy see Banner, 1956.

LOCALITY: 2 specimens from GOC-22.

***Alpheus paracrinitus* (Miers)
bengalensis Coutière, 1905**

For synonymy see Banner, 1956.

LOCALITY: 1 specimen from A-10-12.

Edwardsii Group

***Alpheus crassimanus* (Heller), 1865**

For synonymy see Banner, 1957.

LOCALITY: 1 specimen from A-1.

DISCUSSION: This single specimen is a female and the identification therefore lacks the confirmation obtainable only by the examination of the small chela of the male; however, on all characteristics it is similar to specimens of the same size from Hawaii (see Banner, 1953: 134).

***Alpheus strenuus* Dana, 1852**

For synonymy see Banner, 1957.

LOCALITY: 2 specimens from A-3.

DISCUSSION: Special efforts were made to collect large specimens, presumably of this species, from the windward reef flat where they were abundant. However, it was found impossible, for they lived in burrows in consolidated coral where a geologist's pick would scarcely penetrate.

The Gilbertese on the island informed me that they used this shrimp—and some other species of small chelate shrimp-like crustaceans that I was unable to collect—as food. The shrimp were caught in the back-ridge trough of the windward reef with nets at night when torch fishing. The collective name for this group of decapods is "Teniwarowaro," and my informant stated that their size ranged to 14 inches long (235 cm.). The Gilbertese ate the cephalothorax and abdomen of the shrimp.

***Alpheus pacificus* Dana, 1852**

For synonymy see Banner, 1956.

LOCALITIES: 1 specimen at A-2, 40 at A-3, 3 at A-6, 1 at A-7.

DISCUSSION: Some of the specimens placed in this species are lacking their small chela, so that they can not be positively identified. However, they agree on other characteristics with the complete specimens.

In this group of specimens slight sexual dimorphism is found in the proportions of the small chela, with the fingers of the male being relatively longer (up to twice as long as the palm) than in the female where they are about 1.5 times as long as the palm. However, the characteristic is not constant, especially for those of smaller size where the finger length is quite variable between these limits.

***Alpheus dolerus* Banner, 1956**

For synonymy see Banner, 1956.

LOCALITY: 2 specimens at GOC-51.

DISCUSSION: The finger of the small chela of the male bears a fringe of setae that reaches about half the length of the dactylus on the inner face and a shorter distance on the outer face; this fringe is similar to the fringe of the "balaeniceps-type" chela except that it is continuous over the superior surface of the finger and the finger is not expanded. Otherwise the two specimens are like those of Saipan.

***Alpheus parvirostris* Dana, 1852**

For synonymy see Banner, 1956.

LOCALITIES: 1 specimen at GOC-22, 3 at GOC-28.

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³ These are the title page dates, and evidently do not correspond to the actual dates of publication; however, there appears to be some difference of opinion as to the actual dates of publication.